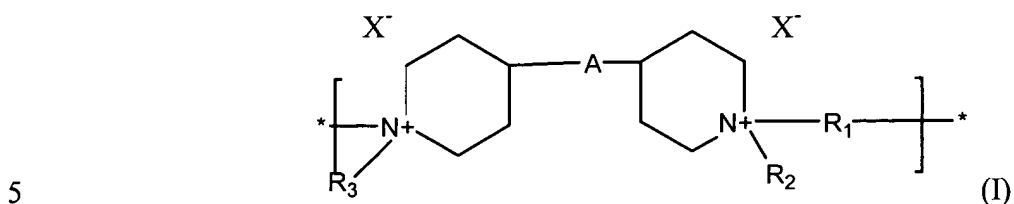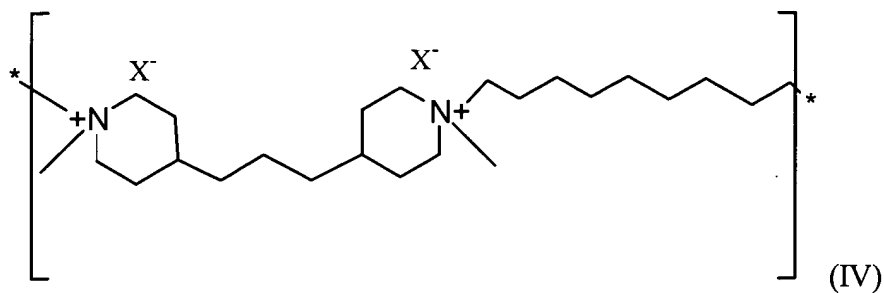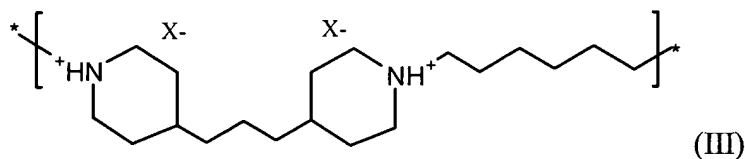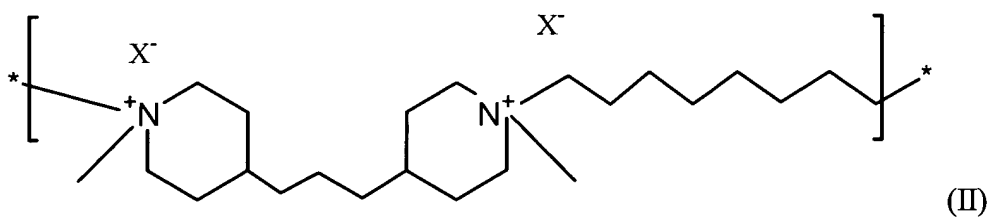What is claimed is:

1.   A polymer or copolymer characterized by a repeat unit having the formula:

5

(I)

wherein R_1 is a substituted or unsubstituted lower alkylene group; R_2 and R_3 are each

independently hydrogen or a substituted or unsubstituted lower alkyl; A is a bond or a

substituted or unsubstituted lower alkylene group; and each X^-, separately or taken

10   together, is a physiologically acceptable anion.

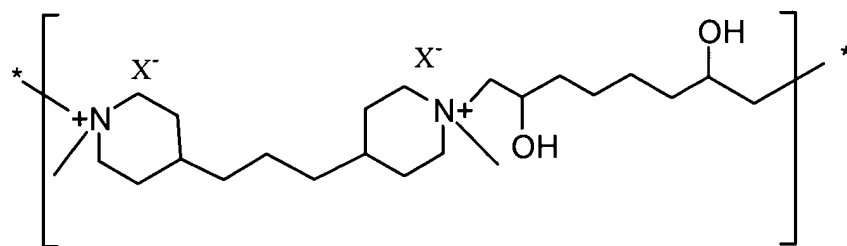2.   The polymer or copolymer of Claim 1 wherein the polymer or copolymer is

characterized by a repeat unit of formula II, III or IV:

(II)

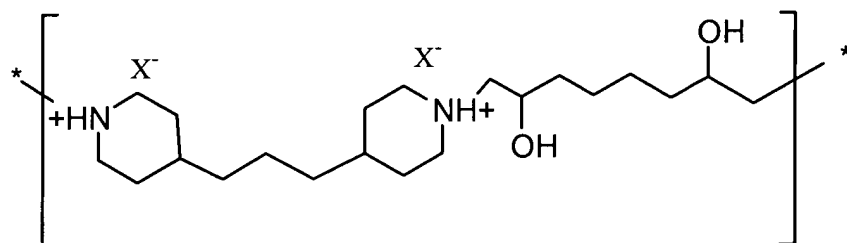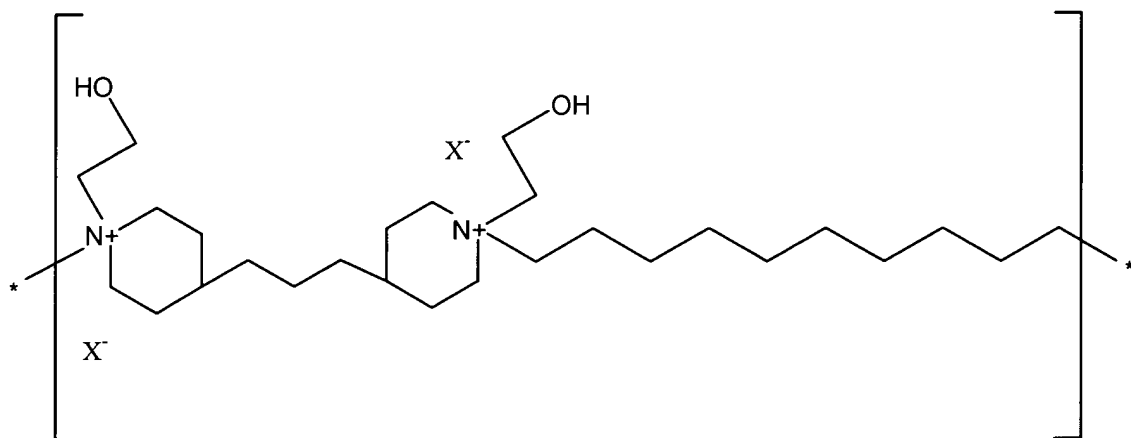15   (III)
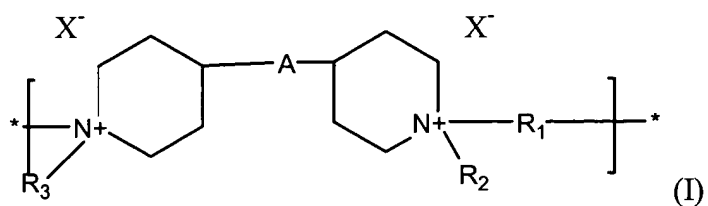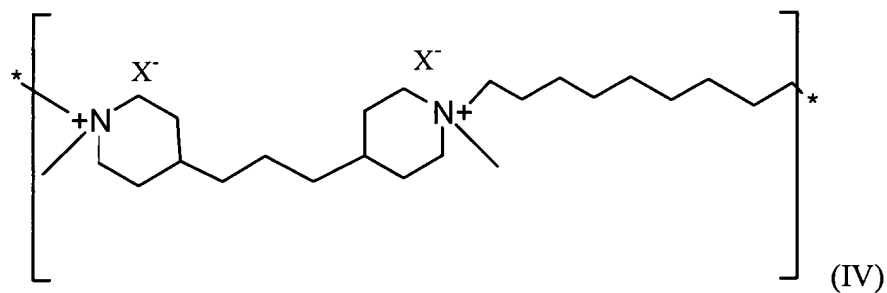

(IV)

(V)

5 (VI)

(VII).
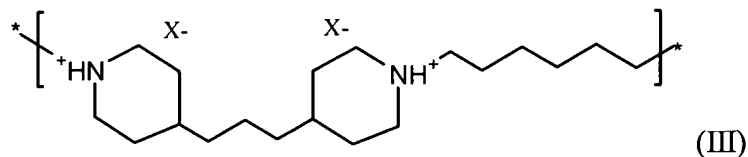
10 3.   A pharmaceutical composition comprising a polymer or copolymer
characterized by a repeat unit having the formula:

-39-

$$\left[\begin{array}{c} \underset{R_3}{\overset{X^-}{\underset{|}{N^+}}} \text{---} A \text{---} \underset{R_2}{\overset{X^-}{\underset{|}{N^+}}} \text{---} R_1 \end{array}\right] * \quad (I)$$

wherein R_1 is a substituted or unsubstituted lower alkylene group; R_2 and R_3 are each

independently hydrogen or a substituted or unsubstituted lower alkyl group; A is a

5   bond or a substituted or unsubstituted lower alkylene group and each X^-, separately or

taken together, is a physiologically acceptable anion; and a physiologically acceptable

diluent or carrier.

4.   The pharmaceutical composition of Claim 3 wherein the polymer or copolymer

10   is characterized by repeat units of formula II, III or IV:

$$(II)$$

$$(III)$$

$$(IV)$$

-40-

(V)

(VI)

5

(VII).

10   5.   A method of treating a microbial infection in a mammal comprising the step of
administering to said mammal a therapeutically effective amount of a polymer or
copolymer of Claim 1.

6.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 2.

5   7.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 3.

8.   A method of treating a microbial infection in a mammal comprising the step of

10   administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 4.

9.   A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer

15   of Claim 1.

10.   A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 2.

20

11.   A polymer or copolymer characterized by a repeat unit of formula VIIIa and a repeat unit of formula VIIIb:

$$* \left[\begin{array}{c} R_4 \quad X^- \\ | \quad + \\ -P\!-\!\!-\!R_3- \\ | \\ R_5 \end{array} \right] * \qquad * \left[\begin{array}{c} R_4 \quad X^- \\ | \quad + \\ -Y\!-\!\!-\!R_3- \\ | \\ R_5 \end{array} \right] *$$
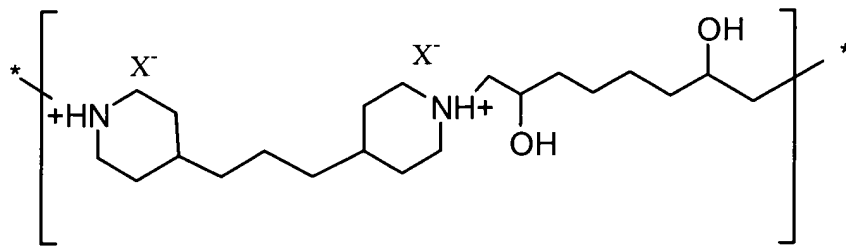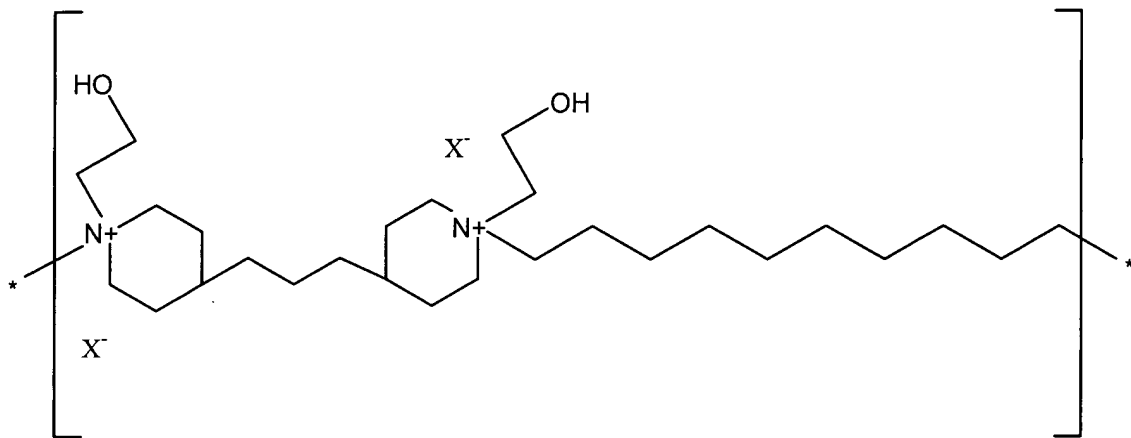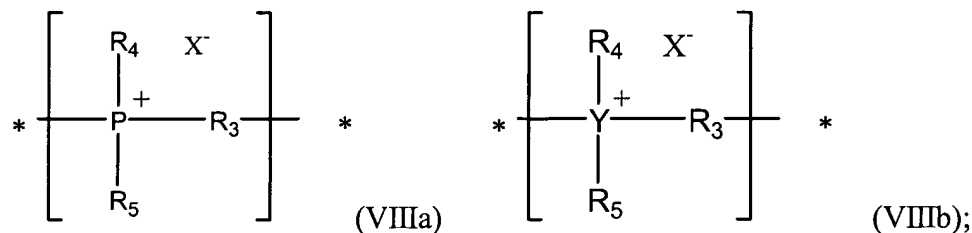
(VIIIa)   (VIIIb);

wherein Y is P or N; R_3 is a substituted or unsubstituted arylene or lower alkylene

25   group, R_4 and R_5 are independently a substituted or unsubstituted aliphatic or aromatic group; and each X^- in the polymer or copolymer, separately or taken together, is a physiologically acceptable anion.

12.   The polymer of copolymer of Claim 11, wherein the polymer or copolymer is characterized by repeat units of the formula:

(IX)

5

wherein R_7 is a substituted or unsubstituted lower alkylene group having from 1 to about 24 carbon atoms and each X^-, separately or taken together, is a physiologically acceptable anion.

10   13.   The polymer of copolymer of Claim 11 wherein the polymer or copolymer is characterized by repeat units of formula X or XI:

(X)

(XI).

14.   A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit of formula VIIIa and a repeat unit of formula Vb:
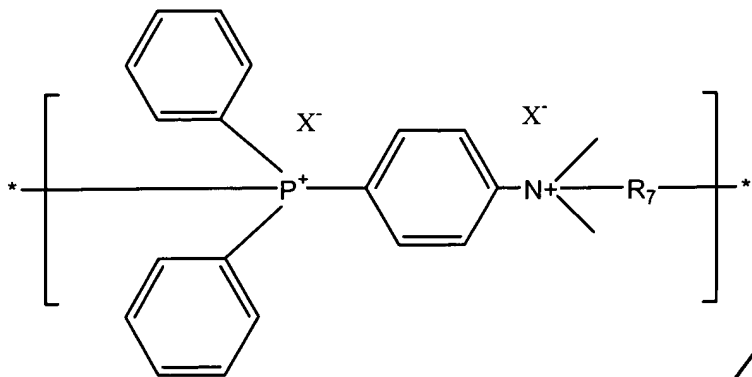

(VIIIa)   (VIIIb)

wherein Y is P or N; R_3 is a substituted or unsubstituted arylene or lower alkylene group, R_4 and R_5 are independently a substituted or unsubstituted aliphatic or aromatic group; and each X^- in the polymer or copolymer, separately or taken together, is a physiologically acceptable anion.

15.   A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit of formula IX:
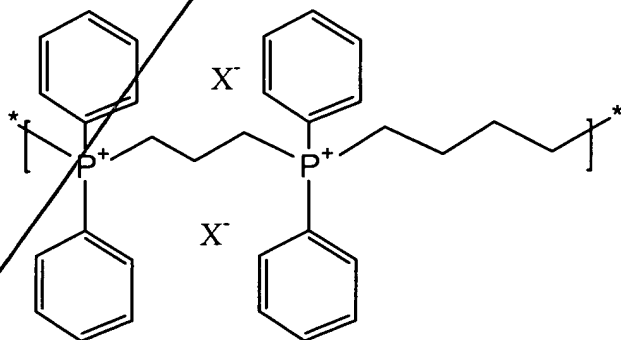

(IX)

-44-

wherein R_7 is a substituted or unsubstituted lower alkylene group having from 1 to about 24 carbon atoms and each X^-, separately or taken together, is a physiologically acceptable anion.
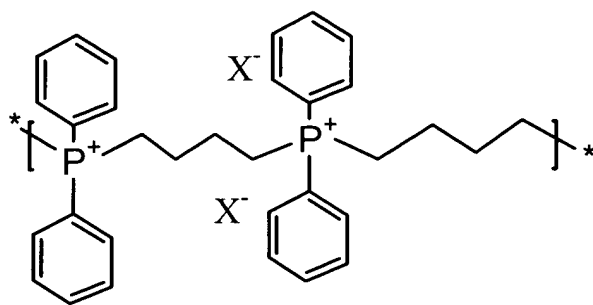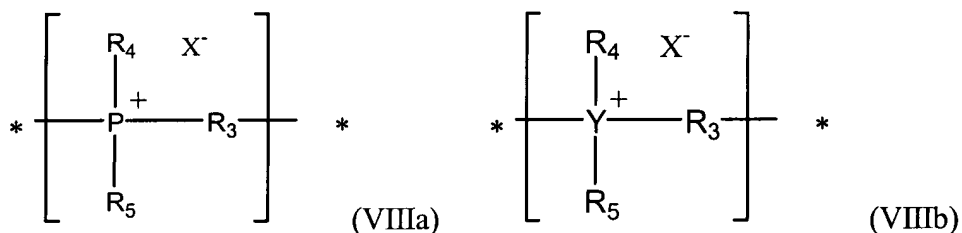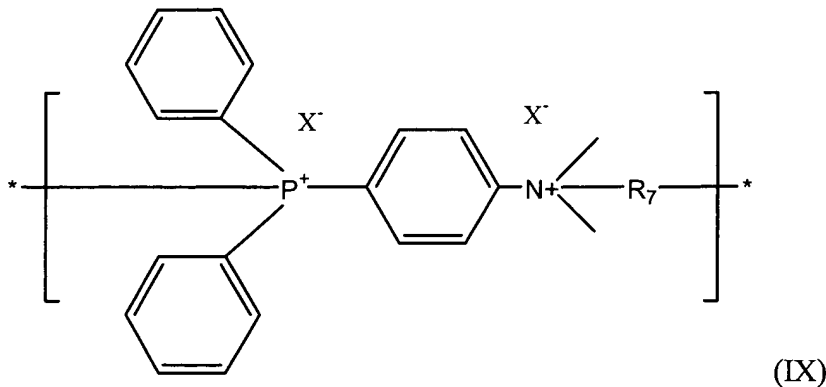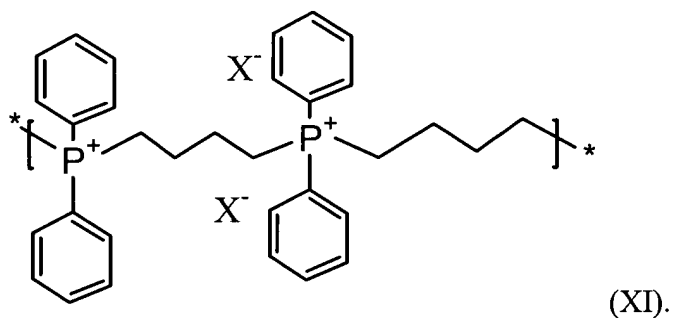
5   16.   The pharmaceutical composition of Claim 14 wherein the polymer or copolymer is characterized by repeat units of formula X or XI:

(X)

(XI).

10   17.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 11.

15   18.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 12.

19. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 13.

5 20. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 14.

21. A method of treating a microbial infection in a mammal comprising the step of 10 administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 15.

22. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical 15 composition of Claim 16.

23. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 11.

20

24. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 12.
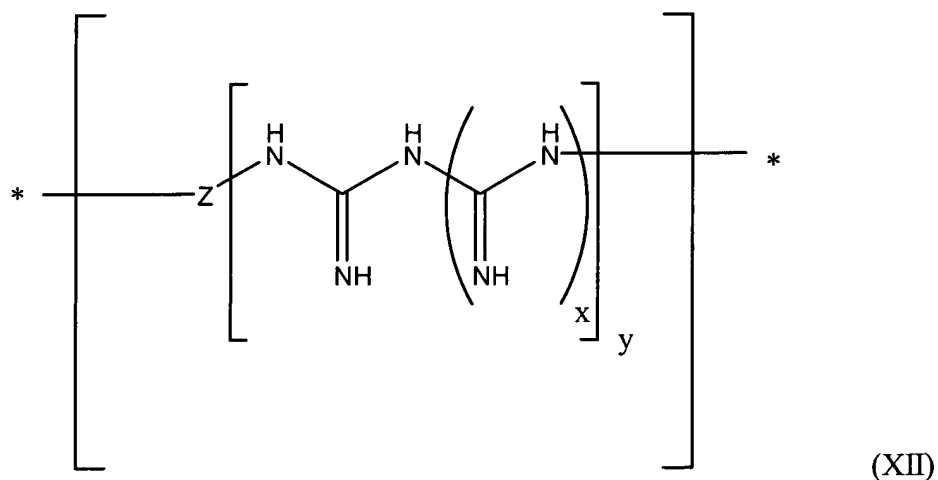
25 25. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 13.

26. A polymer or copolymer characterized by a repeat unit having the formula:

$$\left[\begin{array}{c} * -\!\!\left[\!-Z-\overset{\overset{H}{|}}{N}-\overset{\overset{H}{|}}{\underset{NH}{C}}-\overset{\overset{H}{|}}{N}\left(\overset{\overset{H}{|}}{\underset{NH}{C}}-\overset{\overset{H}{|}}{N}\right)_x\right]_y -\!\!\!- * \end{array}\right]$$
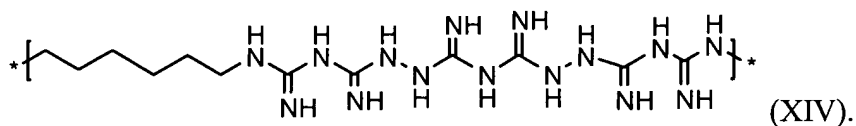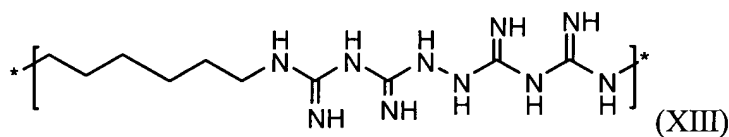
(XII)

and physiologically acceptable salts thereof, wherein Z is a substituted or unsubstituted lower alkylene or lower alkylene glycol group; x is an integer from 1-4; and y is an integer from 2-5.

5

27.   The polymer or copolymer of Claim 26 wherein the polymer and copolymer are characterized by repeat units of formula XIII or XIV:

$$* \left[\!-\!\!-\overset{H}{\underset{NH}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{NH}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{H}{N}}\overset{}{\underset{}{N}}\overset{NH}{\underset{H}{C}}\overset{NH}{\underset{H}{N}}\overset{}{\underset{}{C}}\overset{}{\underset{H}{N}}\!\!-\!\right]* $$ (XIII)

$$* \left[\!-\!\!-\overset{H}{\underset{NH}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{NH}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{H}{N}}\overset{}{\underset{}{N}}\overset{NH}{\underset{H}{C}}\overset{NH}{\underset{H}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{NH}{N}}\overset{}{\underset{}{C}}\overset{H}{\underset{NH}{N}}\!\!-\!\right]* $$ (XIV).

10

28.   A pharmaceutical composition comprising a physiologically acceptable diluent or carrier and a polymer or copolymer characterized by a repeat unit having the formula:

(XII)

or a physiologically acceptable salts thereof, wherein Z is a substituted or unsubstituted lower alkylene or lower alkylene glycol group; x is an integer from 1-4; and y is an integer from 2-5.

29.   The pharmaceutical composition of Claim 28 wherein the polymer or copolymer is characterized by repeat units of formula XIII or XIV:

(XIII)

(XIV).

30.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 26 or a pharmaceutically acceptable salt thereof.

31.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 27 or a pharmaceutically acceptable salt thereof.
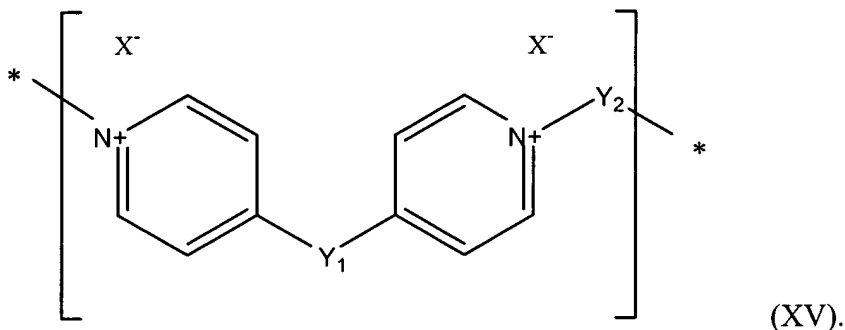
32.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 28.

5   33.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 29.

34.   A method of inhibiting the growth of a microorganism on a surface comprising

10   the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 26 or a pharmaceutically acceptable salt thereof.
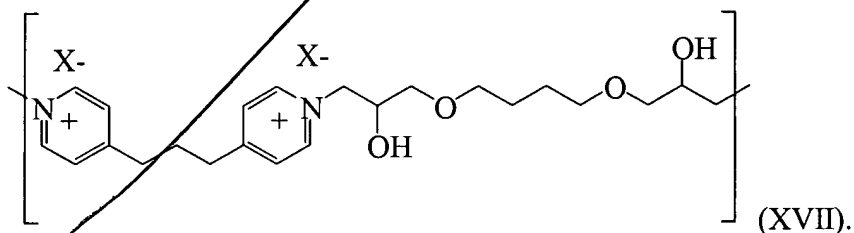
35.   A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer

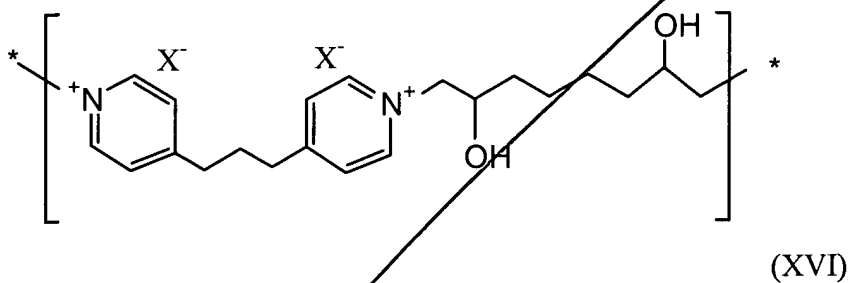15   of Claim 27 or a pharmaceutically acceptable salt thereof.

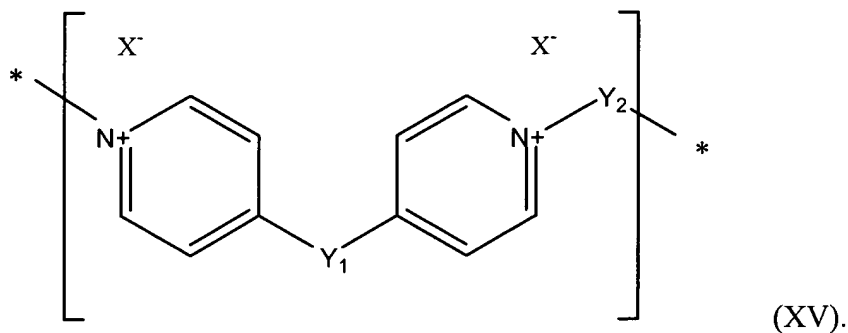36.   A polymer or copolymer characterized by a repeat unit having the formula:

(XV).

20   wherein Y_1 and Y_2 are independently a lower alkylene or lower alkylene glycol group, provided that Y_2 is substituted with two or more alcohol groups; each X^-, separately or taken together, is a physiologically acceptable anion; and said polymer or copolymer is substantially free of diphenol.

25   37.   The polymer of Claim 36, wherein said polymer is a homopolymer.

38. The polymer or copolymer of Claim 36 wherein the polymer or copolymer is characterized by repeat units of formula XVI or XVII:
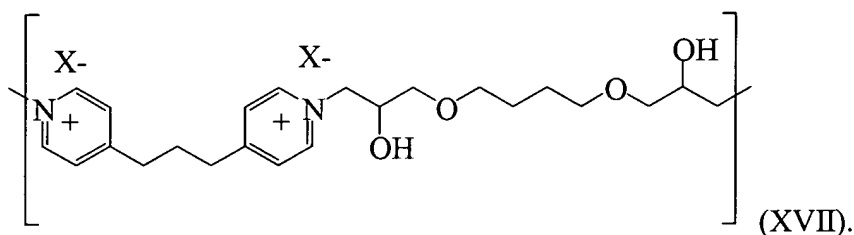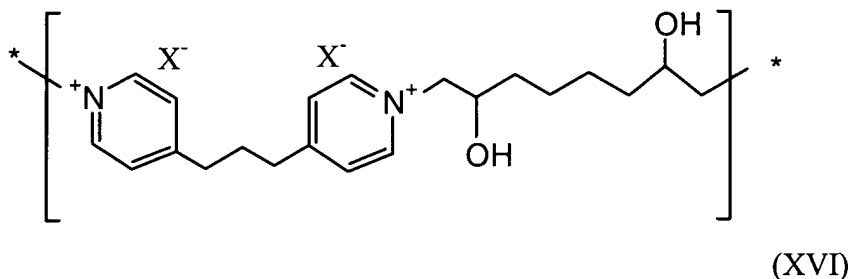

(XVI)

(XVII).

39. A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit having the formula:

(XV).

wherein Y_1 and Y_2 are each independently a substituted or unsubstituted lower alkylene or lower alkylene glycol group; and each X^-, separately or taken together, is a physiologically acceptable anion.

40.   The pharmaceutical composition of Claim 39, wherein at least one lower alkylene or lower alkylene glycol group represented by Y_1 and Y_2 is substituted.

41.   The pharmaceutical composition of Claim 39, wherein the polymer or
5   copolymer is characterized by repeat units of formula XVI or XVII:

$$\text{(XVI)}$$

$$\text{(XVII).}$$

10

42.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 36.

15

43.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a homopolymer of Claim 37.

20   44.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 38.
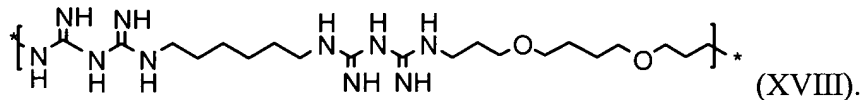
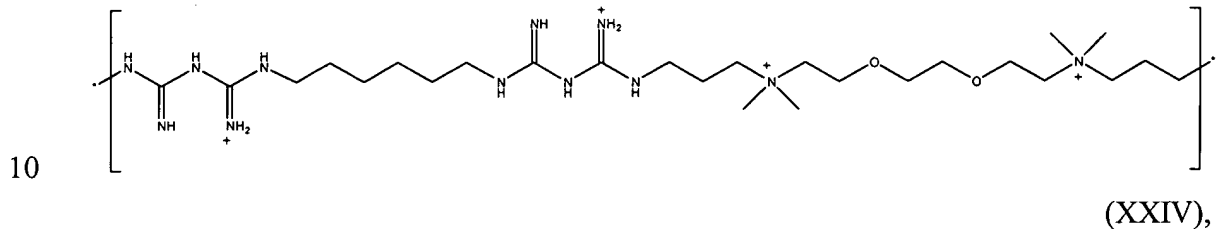45.   A method of treating a microbial infection in a mammal comprising the step of
administering to said mammal a therapeutically effective amount of a pharmaceutical
composition of Claim 39.

5   46.   A method of treating a microbial infection in a mammal comprising the step of
administering to said mammal a therapeutically effective amount of a pharmaceutical
composition of Claim 40.

47.   A method of treating a microbial infection in a mammal comprising the step of
10   administering to said mammal a therapeutically effective amount of a pharmaceutical
composition of Claim 41.

48.   A method of inhibiting the growth of a microorganism on a surface comprising
the step of contacting said surface with an effective amount of a polymer or copolymer
15   of Claim 36.

49.   A method of inhibiting the growth of a microorganism on a surface comprising
the step of contacting said surface with an effective amount of a homopolymer of Claim
37.
20

50.   A method of inhibiting the growth of a microorganism on a surface comprising
the step of contacting said surface with an effective amount of a polymer or copolymer
of Claim 38.

25   51.   A polymer or copolymer characterized by a repeat unit having the formula:

(XVIII)

and physiologically acceptable salts thereof.

52. A pharmaceutical composition comprising a polymer, copolymer or a physiologically acceptable salt thereof, and a pharmaceutically acceptable carrier or diluent, wherein the polymer and copolymer are characterized by a repeat unit having
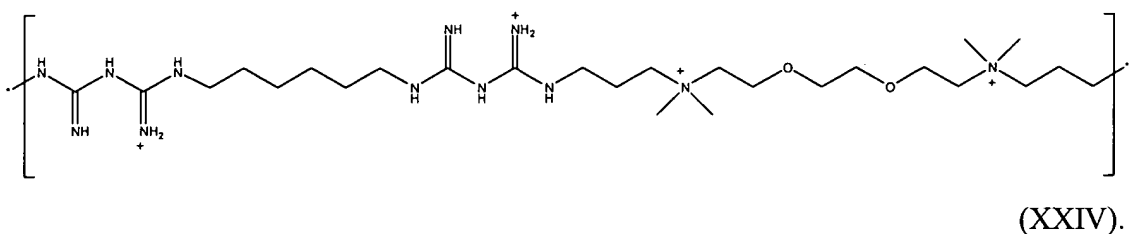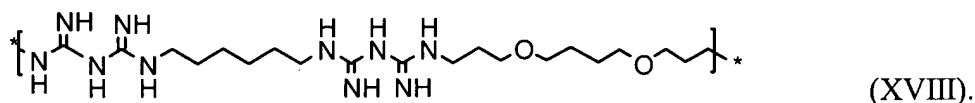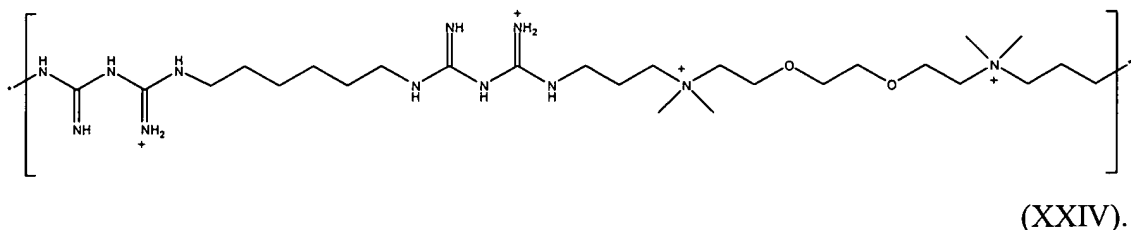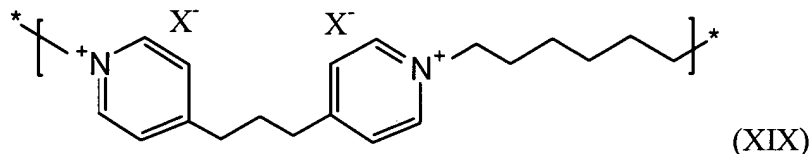
5   the formula:

(XVIII).

53.   A polymer or copolymer characterized by a repeat unit having the formula:

(XXIV),

and physiologically acceptable salts thereof.

54.   A pharmaceutical composition comprising a polymer, copolymer or a

15   physiologically acceptable salt thereof, and a pharmaceutically acceptable carrier or diluent, wherein the polymer and copolymer are characterized by a repeat unit having the formula:

(XXIV).

20

55.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 52.

56. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer, copolymer or physiologically acceptable salt thereof, wherein the polymer or copolymer is characterized by a repeat unit having the formula:

5

(XVIII).

57. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical
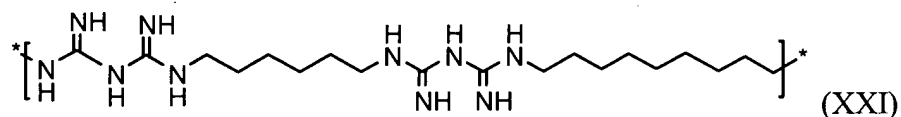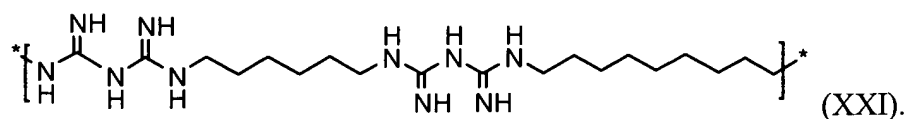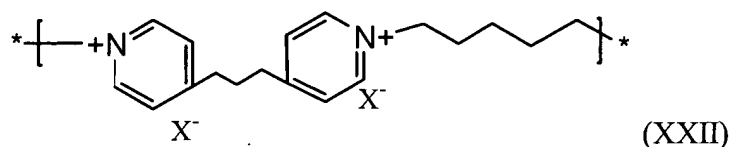
10 composition of claim 54.

58. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer, copolymer or physiologically acceptable salt thereof, wherein the polymer or copolymer is

15 characterized by a repeat unit having the formula:

(XXIV).

59. A pharmaceutical composition comprising a polymer or copolymer

20 characterized by a repeat unit having the formula:

(XIX)

and a pharmaceutically acceptable carrier or diluent, wherein each X⁻, separately or

25 taken together, is a pharmaceutically acceptable anion.

(XXI).

65. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:
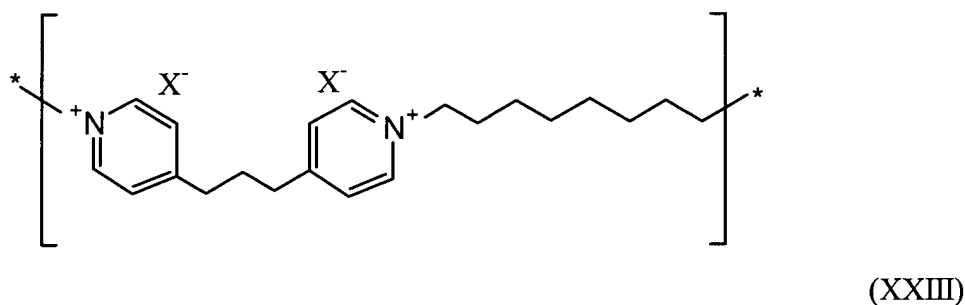
5

(XXII)

and a pharmaceutically acceptable carrier or diluent, wherein each X⁻, separately or taken together, is a physiologically acceptable anion.

10

66. A method of treating a microbial infection of the oral mucosa or gastrointestinal tract of a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 65.

15 67. A copolymer characterized by a repeat unit having the formula:
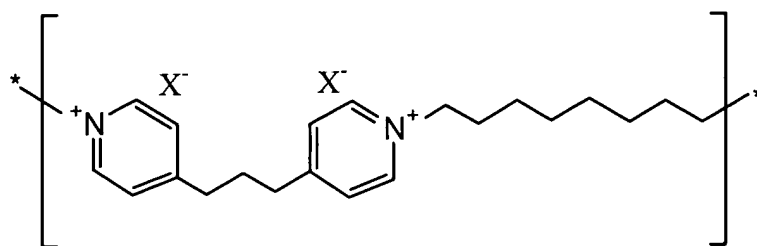

(XXIII)

wherein each X⁻, separately or taken together, is a physiologically acceptable anion.

20

68. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:

(XXIII),

and a pharmaceutically acceptable carrier or diluent, wherein each X⁻, separately or taken together, is a physiologically acceptable anion.

5

69.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a copolymer of claim 67.
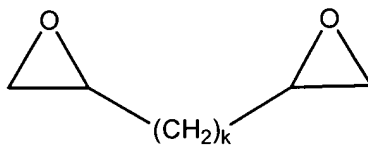
10   70.   A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 68.

71.   A method of inhibiting the growth of a microorganism on a surface comprising

15   the step of contacting said surface with an effective amount of a copolymer of claim 67.

72.   A method of preparing an ionene polymer, comprising the step of reacting an α,ω-diaminoalkane, a diepoxide represented by the formula:
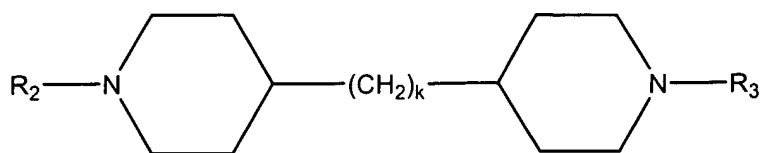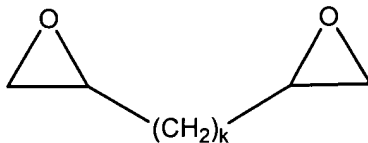

wherein k is an integer from 1 to 10, and an acid.

20

73.   A method of preparing an ionene polymer, comprising the step of reacting an α,ω-alkylenedipiperidine represented by the formula:

$$R_2\!-\!N\!\!\diagdown\!\!\diagup\!-(CH_2)_k\!-\!\diagdown\!\!\diagup\!N\!-\!R_3$$

wherein k is an integer from 1 to 10 and R_2 and R_3 are each independently hydrogen or a substituted or unsubstituted lower alkyl group, a diepoxide represented by the formula:

$$\underset{(CH_2)_k}{\overset{O\qquad\qquad O}{\triangle\diagdown\diagup\triangle}}$$

wherein k is an integer from 1 to 10, and an acid.

74. A method of preparing an ionene polymer, comprising the step of reacting an α,ω-alkylenedipyridine represented by the formula:
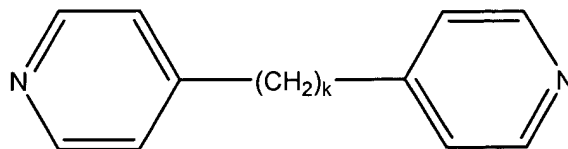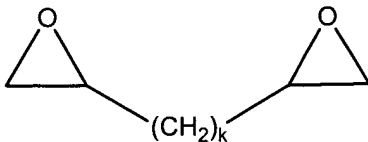
$$N\!\diagdown\!\!\diagup\!\!-(CH_2)_k\!-\!\diagdown\!\!\diagup\!N$$

wherein k is an integer from 1 to 10, a diepoxide represented by the formula:

$$\underset{(CH_2)_k}{\overset{O\qquad\qquad O}{\triangle\diagdown\diagup\triangle}}$$

wherein k is an integer from 1 to 10, and an acid.